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Characterization of Photoconductive Diamond Detectors — Candidate Vacuum Ultraviolet Radiation and Extreme Ultraviolet Radiation Light Source Detectors for Lithography —

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The characteristics of an ultraviolet (UV) and vacuum ultraviolet (VUV) radiation photodetector with a photoconductive highly oriented diamond (HOD) film were evaluated using continuous light sources (a low-pressure mercury lamp and a xenon excimer lamp) that mainly emit light in the UV range. It was confirmed that the change in the spectral responsivity of the photodetector is extremely limited upon continuous UV radiation. In this report, the results of the evaluation of the characteristics of the UV photodetector with a photoconductive diamond film (hereafter, diamond UV photodetector) using continuous light sources are reported. We also found that the diamond UV photodetector has characteristics enabling its use as a photodetector for ArF excimer lasers and extreme ultraviolet (EUV) light sources, as a result of the evaluation using a light source employed in lithography. The results are also described. The evaluation of the diamond UV photodetector using an ArF excimer laser revealed that it can detect a laser with a pulse width of 5 ns. Also, good linearity between the pulse energy and the output was observed for pulse energies of 1–100 μJ/cm^2. By the measurement of the spectral responsivity to synchrotron radiation, the diamond UV photodetector was found to have high spectral responsivity in the wavelength range of 10–33 nm. According to the results given above, the diamond UV photodetector has sufficient time responsiveness (follow-up performance) to enable the measurement of ArF excimer lasers and sufficient spectral responsivity to detect light in the EUV region, suggesting its use as a photodetector of light sources used in lithography.

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